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# A Study on Current Technologies of Microprocessor and Microcontroller

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**ABSTRACT:** Microprocessor and Microcontroller is a part of computer that plays an important role in today's technology. Microprocessor is like a brain of the computer that goes into motion when the computer is switched on. Microcontroller is mostly used in the automatically controlled devices now a days because for the development of the new automatic and Artificial technology. Microcontroller has a chip like structure that is optimized to control electronic devices.

**KEYWORDS:** Register Array, Program Counter, Hyperthreading, Arithmetic Logic Unit, Control Unit.

## I. INTRODUCTION

Microprocessor is a controlling unit of a micro-computer actually. It is an electric device that helps computer to do its own work. Its structure is like a circuit chip that contains millions of things like transistors, registers, diodes and so on. It acts like central processing unit (CPU) that consists of Arithmetic Logical Unit, Registers and Control unit. It helps in solving mathematical problems like adding, subtracting, multiplication etc., logical operations and comparing numbers etc. Generally, microprocessors are used for complex operations but also in the high-end systems like computers, tablets, smartphones etc. It can be categorized according to the generations or according to the size of the microprocessor:

First Generation (4-bit Microprocessor): It were introduced in the year 1971-1972 by Intel Corporation. It was named Intel 4004 since it was a 4-bit processor. It was a processor on a single chip. It could perform simple arithmetic and logical operations such as addition, subtraction, Boolean OR and Boolean AND.

Second Generation (8-bit Microprocessor): It were introduced in 1973 again by Intel. It was a first 8-bit microprocessor which could perform arithmetic and logic operations on 8-bit words. It was Intel 8008, and another improved version was Intel 8080.

Third Generation (16-bit Microprocessor): This microprocessor, introduced in 1978 were represented by Intel's 8086, Zilog Z800 and 80286, which were 16-bit processors with a performance like mini computers.

Fourth Generation (32-bit Microprocessors): Several different companies introduced the 32-bit microprocessors, but the most popular one is the Intel 80386.

Fifth Generation (64-bit Microprocessors): From 1995 to now we are in the fifth generation. After 80856, Intel came out with a new processor namely PENTIUM processor followed by Pentium Pro CPU, which allows multiple CPUs in a single system to achieve multiprocessing. Other improved 64-bit processor are CELRON, DUAL, QUAD, OCTA CORE Processors.

Microcontroller is a small micro-computer that is designed to perform tasks for the embedded applications (automatically controlled systems) as appliances like washing machines, microwave etc., automatic engine control system, remote control toys, power tools etc. It consists of the processor, the memory (RAM, ROM, EPROM), other peripheral devices, serial ports.



There are many types of microcontrollers according to many of basis:

1. On the basis of bus-width: Bus Width, 8-bit Microcontroller, 16-bit Microcontroller, 32-bit Microcontroller.
2. On the basis of Memory: Embedded memory Microcontroller, External memory Microcontroller.
3. On the basis of Instruction Set Architecture: CISC (Complex Instruction Set Computer), RISC (Reduced Instruction Set Computer).
4. On the basis of Microcontroller Architecture: Harvard Architecture Microcontroller, Von Neumann (or Princeton) Architecture Microcontroller.
5. Various types of generally used Microcontrollers: PIC Microcontroller, 8051 Microcontroller, AVR Microcontroller, ARM Microcontroller, RENESAS Microcontroller.

## II. LITERATURE REVIEW

Now a days, there is so much evolution takes place in field of microprocessor and microcontroller.

But because in this research paper, we are epically focusing on the rise of new technology regarding microcontroller and microprocessor. There have been many questions regarding with the Why do we need a microprocessor? Why do we need a microcontroller? Etc. In this paper, we describe the results of the study of description about microcontroller and microprocessor.

There are number of technology and business consideration to keep in mind when choosing a microcontroller for a project. Beyond cost, it is important to consider maximum speed, amount of RAM and ROM, number of I/O Pins on a Microcontroller. Be sure to ask questions such as: What hardware peripherals are required? Are external communications needed? What is the market availability of the microcontroller? Among microcontroller and microprocessor which is the best to use to make your computer flexible?

The results of the study yields, a specific research contribution about today's technology about the micro-controller and microprocessor. It describes the upgrade versions of microcontrollers and microprocessors.

## III. BLOCK DIAGRAM

In Microprocessor, Components we have:

- Input Device
- CPU (ALU + CU + Register Array)
- Output Device
- Memory Unit

In Microcontroller, Components we have:

- CPU
- Memory (RAM, ROM, EPROM)
- Parallel input/output ports
- Serial Ports
- Timers/Counters
- ADC (Analog to Digital Converter)
- DAC (Digital to Analog Converter)
- Interrupt Control

- Special functioning block

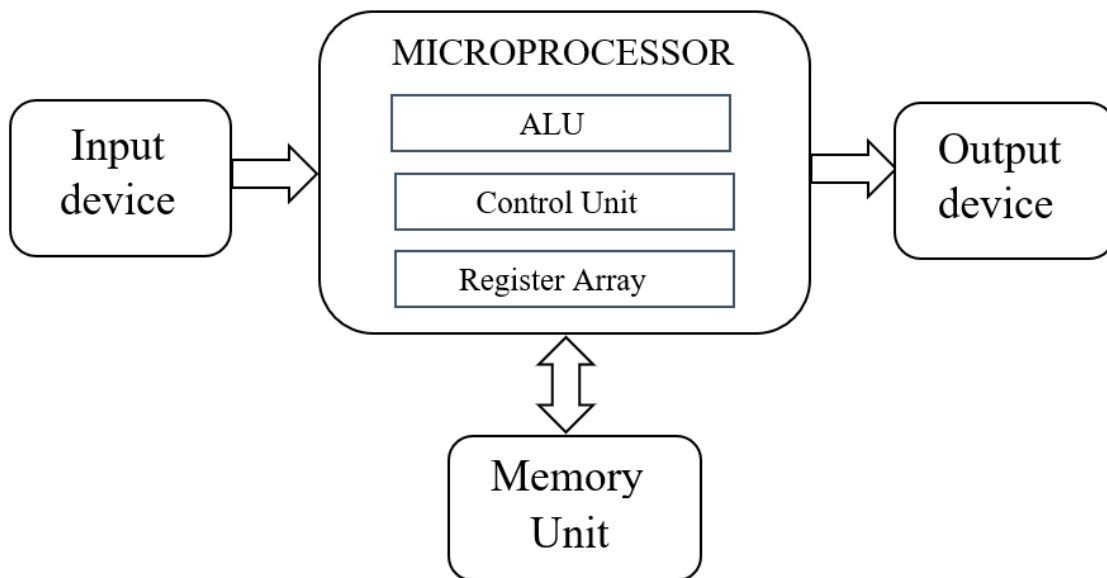


Figure 3.1 Block diagram of Microprocessor

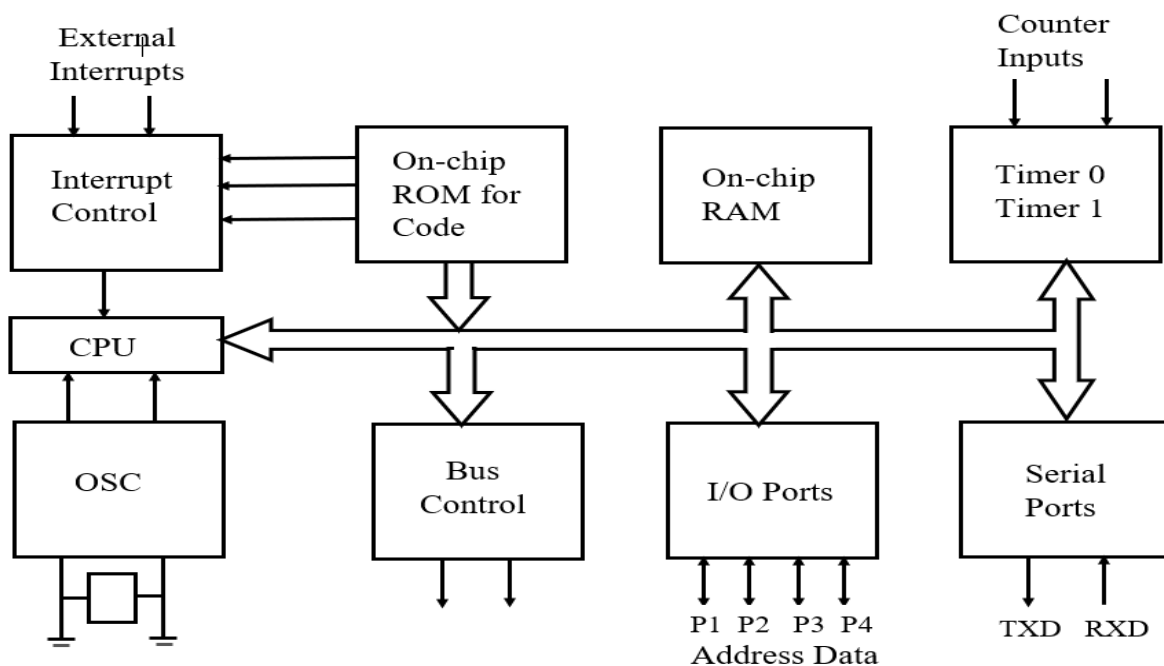


Figure 3.2 Block diagram of Microcontroller



#### IV. COMPARISON BETWEEN MICROPROCESSOR AND MICROCONTROLLER

##### MICROPROCESSOR

Microprocessor is heart of computer system.

It is just a processor. Memory and I/O components have to be connected externally.

Cannot be used in compact systems and hence inefficient.

Cost of the entire system increases.

Due to external components, the entire power consumption is high. Hence it is not suitable to use with devices running on stored power like batteries.

Most of the microprocessors don't have power saving features.

Microprocessors are based on Von Neumann model/architecture where program and data are stored in same memory module.

Mainly used in personal computers.

##### MICROCONTROLLER

Microcontroller is a heart of embedded system.

Microcontroller has external processor along with internal memory and I/O components.

Can be used in compact systems and hence it is an efficient technique.

Cost of the entire system is low.

Since external components are low, total power consumption is less and can be used with devices running on stored power like batteries.

Most of the microcontrollers have power saving modes like idle modes and power saving mode. This helps to reduce power consumption even further.

Microcontrollers are based on Harvard architecture where program memory and data memory are separate.

Used mainly in washing machines, MP3 players

#### V. WORKING AND FUNCTIONING

A **Microprocessor** is the brain of a computer which basically consists of Arithmetic and Logical Unit (ALU), control unit and register array. As the name indicates ALU performs all arithmetic and logical operations on the data received from input devices or memory. Register array consists of a series like accumulator (A,B,C,D) etc. which acts as temporary fast access memory locations for processing data. As the name indicates, control unit controls the flow of instructions and data throughout the system. So, basically a microprocessor takes input from input devices, process it as per instructions given in the memory and produces the output.

The Microprocessor follows a sequence to execute the instruction: Fetch, Decode, and then Execute. Initially, the instructions are stored in the storage memory of the computer in sequential order. The Microprocessor fetches those instructions from the stored area (memory) then decode its and execute those instruction till STOP instruction is met. Then, it sends the result in binary form to the output part. Between these processes, the register stores the temporary data and ALU (Arithmetic and Logical Unit) performs the computing function. It has features like low cost, high speed, small-size, versatile, low power consumption, less heat generation, reliable and portable.

In **Microcontroller**, when the power supply is switched on, the crystal oscillator triggers, clock, pulses and generates the frequency. After sometime, the oscillate gets stabilized. Now, the microcontroller starts its working from the program counter (PC). The Program Counter address stored in the ROM. The PC stores the address of the next instruction to be executed. It performs the instruction from the start address of the program counter. This address is sent to the instruction decoder which will understand and completes the instructions.

In this, microcontroller's cost and size are less. The interfacing of peripherals becomes easy with I/O Ports and the speed of execution is faster in terms of speed and memory. They are fast and consume little power. Microcontroller can



take the inputs from the device they controlling and retain control by sending the device signals to different parts of the device. A good example is a TVs Microcontroller, it takes input from a remote control and delivers its output on a TV screen.

**Comparison between core i3, core i5, and core i7**

No.	S.	Core i3	Core i5	Core i7
1.		Entry level processor	Mid-range processor	High end processor
2.		2-4 Cores	2-4 Cores	4 Cores
3.		4 Threads	4 Threads	8 Threads
4.		Hyper-Threading (efficient use of processor resources)	Hyper-Threading (efficient use of processor resources)	Hyper-Threading (efficient use of processor resources)
5.		3-4 MB Cache	3-8 MB Cache	4-8 MB Cache
6.		32 nm Silicon (less heat and energy)	32-45 nm Silicon (less heat and energy)	32-45 nm Silicon (less heat and energy)

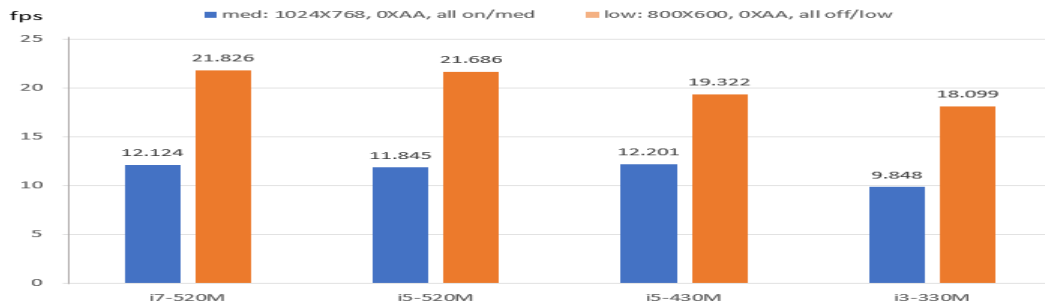


Figure 5.1 Performance Graph between core i3,i5 and i7

**VI. RESULT**

According to the given information about microcontroller and microprocessor in this table, if you need to access a large amount of really fast memory then a microprocessor is likely your best option. A microcontroller is already embedded with memory so the memory choices are fewer with a microprocessor. The maximum amount of flash memory available with most microcontrollers is usually around 2 MB.



## VII. CONCLUSION

In brief the conclusion is here that microcontrollers and microprocessors are different ways of organizing and optimizing a system based on CPU. While a microcontroller puts the CPU and all peripherals onto the same chip, microprocessor houses a more powerful CPU on a single chip that connects to external peripherals. Microcontrollers are used to perform dedicated low power applications ideal for embedded systems but microprocessors are more useful for general computing applications that require more complex and versatile computing operations.

So, recent days advancements are rising in the field of microprocessors and microcontrollers designing like:

- i. 64-bit Microprocessors and the consumer market
- ii. Ongoing mobile - Need for mobile CPUs, Mobile variants of desktop CPUs, Specially, designed power-saving CPUs (Intel Centrino, Transmeta, ARM -small and powerful)

Latest microcontrollers released about last 12 months such as LAPIS ML620530/540/550, Microchip PIC16F18877, Renesas RX231, Freescale S32K MCU, Renesas RL 78/G1F, Atmel SMART SAM G54/G55, Marvell 88MZ300 wireless microcontroller system-on-chip(SoC) etc.

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